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TABLE 1 compares onset temperatures for bulk-scaffolded materials (e.g., AB on mesoporous silica supports) at various ratios against neat AB.

TABLE 1

ΔH values for bulk-scaffolded materials at different heating rates compared to neat AB.					
Sample	Iso <sup>ΔΔ</sup>	Heating Rate			Onset temp (° C.)
		0.1 (° C./min)	0.5 (° C./min)	1.0 (° C./min)	
neat (AB)	22 kJ (80° C.)	22 kJ	22 kJ	22 kJ	110
AB:MCM-41 (1:1)*	1.5 (50° C.)	7 kJ	10.4 kJ	20 kJ	60
AB:MCM-41 (1:1)**	—	9 kJ	10 kJ	10 kJ	120
AB:MCM-41 (2:1)*	—	—	—	9.5 kJ	90
AB:MCM-41 (3:1)*	—	—	—	12 kJ	90
AB:MCM-41 (1:1)*	—	—	—	60 kJ	60
[+Al (1%)] <sup>Δ</sup>	—	—	—	—	—
AB:MCM-41 (1:1)**	—	—	—	54 kJ	120
[+Al (1%)] <sup>Δ</sup>	—	—	—	—	—
AB:MCM-41 (1:1)*	—	—	—	14 kJ	60
[+Al (5%)] <sup>Δ</sup>	—	—	—	—	—
AB:MCM-41 (1:1)**	—	—	—	60 kJ	120
[+Al (5%)] <sup>Δ</sup>	—	—	—	—	—

\*1<sup>st</sup> equivalent of hydrogen

\*\*2<sup>nd</sup> equivalent of hydrogen

<sup>Δ</sup>Percentages correspond to quantity (by weight) of aluminum (Al) added to the support of the bulk-scaffolded material tested.

<sup>ΔΔ</sup>Iso = Isothermal heating at the listed temperature.

In the table, data show that the thermodynamics of hydrogen release is altered for bulk-scaffolded hydrogen storage and releasing materials at the various loadings. For example, temperature at which hydrogen is released from the mesoporous supports of the bulk-scaffolded materials is typically reduced; enthalpy of reaction can also be altered or reduced. In the table, addition of aluminum to the support material also modifies the surface chemistry of the silica supports. Hydrogen release is still achieved, although enthalpy of reaction is altered. Onset temperatures for release of the hydrogen change as a function of loading and are also dependant on the nature of the scaffold surface. Onset temperatures gradually increase as loading on the scaffold increases, but are always lower than release temperatures of the neat material.

#### Example 8

#### Hydrogen Release Temperature

1:1 Composite

AB:SBA-C

In another experiment, a 1:1 bulk-scaffolded hydrogen storage and releasing material composed of AB and SBA-C (mesoporous carbon) was prepared. The mesoporous carbon support was prepared using a nanocasting process described, e.g., by Jun et al. (in *J. Am. Chem. Soc.* 2000, 122, 10712) and Joo et al. in (*Nature* 2001, 412, 169), which references are incorporated herein by reference. In this process, a silicate template, SBA-15, was impregnated with a carbon source (e.g., resorcinol/formaldehyde or another carbon source) and pyrolyzed to structure the mesoporous carbon. Silica in the template was then dissolved leaving the SBA-C mesoporous carbon support behind. AB was then dissolved in solution in

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tetrahydrofuran solvent and applied to the mesoporous carbon support, forming the AB:SBA-C bulk-scaffolded hydrogen storage and releasing material. FIG. 10 plots the change in heat (measured by DSC) and release of hydrogen [measured by mass spectrometry MS)] from the (1:1) AB:SBA-C material as a function of temperature. In the figure, release of hydrogen from the bulk scaffolded material begins as low as 30° C. below the temperature corresponding to the neat material. Thus, bulk-scaffolded AB:SBA-C material also enhances hydrogen release properties of ammonia borane. Results demonstrate that hydrogen release can be achieved at much lower temperatures compared to the neat materials alone.

We claim:

1. A method for making a bulk-scaffolded hydrogen storage and releasing material, characterized by the steps of: combining a preselected ratio of at least one hydrogen storage and releasing compound with a porous support by:

mixing said at least one hydrogen storage and releasing compound in a solvent to form a solution;  
wetting said porous support with said solution; and  
drying said porous support to form said bulk-scaffolded hydrogen storage and releasing material.

2. The method of claim 1 wherein said at least one hydrogen storage and releasing compound includes a member selected from the group consisting of Li, Be, B, C, N, O, F, Na, Mg, Al, Si, P, and combinations thereof.

3. The method of claim 1, wherein said porous support is a mesoporous material having a pore size ranging between 2 nm to 50 nm.

4. The method of claim 1, wherein porous support comprises at least 20% porosity by volume.

5. The method of claim 1, wherein said porous support comprises mesoporous silica.

6. The method of claim 1, wherein said porous support comprises carbon.

7. A bulk-scaffolded hydrogen storage and releasing material, comprising:

a preselected ratio of at least one hydrogen storage and releasing compound combined with a mesoporous silica support, said bulk-scaffolded hydrogen storage and releasing material being capable of releasing a bulk quantity of hydrogen at a greater rate and a lower temperature than said at least one compound alone.

8. The bulk-scaffolded hydrogen-storage and releasing material of claim 7, wherein said at least one hydrogen storage and releasing compound includes a member selected from the group consisting of Li, Be, B, C, N, O, F, Na, Mg, Al, Si, P, and combinations thereof.

9. The bulk-scaffolded material of claim 7, wherein said mesoporous silica support has a pore size between 2 nm to 50 nm.

10. The bulk-scaffolded material of claim 7, wherein said mesoporous silica support comprises at least 20% porosity by volume.

11. The bulk scaffolded material of claim 7, wherein said bulk-scaffolded hydrogen storage and releasing material releases hydrogen at a temperature at least ten degrees lower than said hydrogen storage and releasing compound alone.

12. The bulk-scaffolded material of claim 7, wherein said bulk-scaffolded hydrogen storage and releasing material releases hydrogen at a temperature below about 95° C.

13. The bulk-scaffolded material of claim 7, wherein said bulk-scaffolded hydrogen storage and releasing material releases hydrogen at a temperature below about 85° C.